REPLACEMENT PARAGRAPHS

The hollow needle 8 is secured in a hub 9 situated at the opposite end of the barrel 1 from the plunger 2. The hollow needle 8 comprises a first component extending outwardly from the barrel 1 and the hub 9 and a piercing component extending from the hub 9 into the second ~~chamber~~ compartment 6 of the barrel 1. The hollow needle 8 is provided with a porthole 7 to assure full delivery of fluid contained within the second ~~chamber~~ compartment 6.

In the operation of the syringe 10 a first fluid is loaded into the second ~~chamber~~ compartment 6 and a second fluid is loaded into the first ~~chamber~~ compartment 4. As the push stopper 3 is forced downwardly (Figure 1) into the barrel 1 under the action of the plunger 2, the fluid within the first ~~chamber~~ compartment 4 and the floating plunger 5 function to force the first fluid outwardly from the second ~~chamber~~ compartment 6 through the hollow needle 8. As the floating plunger 5 moves downwardly it eventually engages the piercing component of the hollow needle 8 which begins to penetrate the floating ~~chamber~~ plunger 5. Meanwhile, the remainder of the first fluid is forced out of the second ~~chamber~~ compartment 6 through the porthole 7 and the hollow needle 8.

Continued downward movement of the push stopper 3 under the action of a plunger 2 causes the piercing component of the hollow needle 8 to fully pierce the floating plunger 5 thereby allowing the second fluid to flow outwardly from the first ~~chamber~~ compartment 4 through the hollow needle 8. Movement of the push stopper 3 toward the hollow needle 8 under the action of the plunger 2 continues until all of the second fluid has been discharged from the syringe 10 through the hollow needle 8.

In the practice of the first embodiment of the invention a first fluid to be administered is loaded into the barrel of the syringe below the floating piston. A second fluid to be delivered is loaded into the barrel of the syringe above the floating piston. As the plunger of the syringe is moved into the barrel, the first fluid is forced outwardly through the needle of the syringe under the action of the second fluid and the floating piston. The floating piston eventually engages the discharge end of the barrel thereby forcing the entirety of the first fluid outwardly through the needle. Continued movement of the plunger of the syringe causes the penetrating needle of the floating piston to penetrate the seal comprising the upper portion of the floating piston. At this point the second fluid is connected in fluid communication with the syringe needle through the penetrating needle of the floating piston. Further inward movement of the plunger of the syringe forces all of the second fluid outwardly through the penetrating needle of the floating piston and the syringe needle.

The piercing needle 50 is hollow throughout its length and is preferably either equal to or greater in diameter than the needle 24 of the syringe 20. The piercing needle 50 may be provided with an enlarged portion at the end thereof facing the needle 24 of the syringe 20 in order to assure fluid communication between the piercing needle 50 and the ~~syringe~~ hollow needle 24.

The upper portion 44 of the floating piston 40 comprises a non-coring elastomeric material. In use, the upper portion 44 forms a fluid tight seal with the interior surface of the barrel 22 of the syringe 20. As will be appreciated by those skilled in the art, the function of the ~~upper~~ lower portion 42 of the floating piston 40 is to divide barrel 22 of the syringe 20 into upper and lower chambers and to initially maintain a fluid-tight barrier therebetween.

Referring next to Figure 4, administration of the first fluid is accomplished by moving the plunger 30 inwardly, that is, from the position illustrated in Figure 2 toward the position illustrated in Figure 4. As the plunger 30 is moved inwardly, the floating piston 40 and the second fluid positioned within the barrel 22 of the syringe 20 betweeen the floating piston 40 and the plunger 30 function to force the first fluid out of the barrel 22 through the ~~syringe~~ hollow needle 24. Figure 4 illustrates the floating piston 40 bottomed out in the barrel 22 of the syringe 20 with all of the first fluid having been delivered through the ~~syringe~~ hollow needle 24.

Referring next to Figure 5, further inward movement of the piston [[30]] 32 compresses the resilient material 46 and/or the gas comprising the lower portion 42 of the floating piston 40 thereby causing the piercing needle 50 to penetrate the upper portion 44 of the floating piston 40. In this manner the second fluid to be administered, which is situated between the floating piston 40 and the plunger 30, is connected in fluid communication with the ~~syringe~~ hollow needle 24 through the hollow interior of the piercing needle 50. Further inward movement of the plunger 30 forces the second fluid to be administered out of the barrel 22 of the syringe 20 through the piercing needle 50 and the ~~syringe~~ hollow needle 24. This action continues until the piston 32 of the plunger 30 bottoms out as illustrated in Figure 6. At this point the syringe 20 is typically disposed of in accordance with approved syringe disposal techniques.

Referring to FIGURES 7 through 10, inclusive, there is shown a syringe 60 comprising a second embodiment of the present invention. In many respects the syringe 60 is conventional in construction and operation. Thus, the syringe 60 includes a barrel 62 which receives fluid to be administered. A hollow needle 64 is secured to one end of the barrel 62 by a hub 66 and is ~~couple~~ coupled in fluid communication with the interior of the barrel 62. The end of the barrel 62 remote from the needle 64 may be provided with a radially extending flange 68 which is typically engaged by the fingers of an individual operating the syringe 60.

The syringe 60 differs from conventional syringes in that it is provided with a floating piston 80. The floating piston 80 includes a body 82 formed from a spongy, resilient material. As will be apparent to those skilled in the art, it is necessary that the body 82 is formed from a material having sufficient resiliency to form a fluid tight seal with the interior wall of the barrel 62. The floating piston 80 further includes a valve 84 which is formed from a substantially rigid material. Both the body 82 and the ~~valve~~ upper portion 44 are formed from materials which are impervious to attack by the fluids which are administered by the syringe 60.

The valve 84 includes an imperforate top plate 92 which normally seals the upper end of the passageway 90 formed in the body 82. The lower end of the valve 84 comprises a perforated plate 94 comprising a plurality of apertures 96 which facilitate fluid flow through the lower end of the passageway 90. A rod 98 connects the imperforate top plate 92 to the perforated ~~bottom~~ lower plate 94.

The administration of the first fluid is accomplished by moving the plunger 70 inwardly, that is, from the position illustrated in FIGURE 7 toward the position illustrated in FIGURE 8. As the plunger 70 is moved inwardly, the floating piston 80 and the second fluid positioned within the barrel 62 of the syringe 60 between the floating piston 80 and the plunger 70 function to force the first fluid out of the barrel 62 through the ~~syringe~~ hollow needle 64. FIGURE 6 illustrates the floating piston 80 bottomed out in the barrel 62 of the syringe 60 with all of the first fluid having been delivered through the ~~syringe~~ hollow needle 64.

Further inward movement of the piston [[70]] 72 compresses the material comprising the body 82 of the floating piston 80. Due to the relative rigidity of the ~~seat~~ valve 84, as compared with the relative compressibility of the material comprising the body 82, compression of the body 82 of the floating piston 80 under the action of the plunger 70 causes separation between the top of the passageway 90 formed through the body 82 of the floating piston 80 and the imperforate top plate 92 of the valve 84. Such separation opens the passageway 90 through the body 82 thereby allowing the second fluid to flow through the body 82 of the floating piston 80 and through the needle 64 for administration to the patient. Inward movement of the plunger 70 continues until all of the fluid that was originally contained in the portion of the barrel 62 located between the plunger 70 and the floating piston 80 is dispensed.

It will therefore be understood that the present invention comprises a syringe for sequentially administering different fluids which overcomes the problems that have characterized the prior art. In particular, manufacture of the syringe of the present invention involves the addition of a unique floating piston to an otherwise conventional syringe. Manufacture of the ~~components~~ component parts of the syringe of the present invention does not involve complicated and expensive manufacturing techniques, nor does it involve precise control over the dimensions of the component parts of the device.